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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Steven Paul Randall et al.

Examiner: Cuevas, Pedro J.

Serial No.: 10/765,506

Group Art Unit: 2837

Filed: January 27, 2004

Docket: K315.133.101

Title: VARIABLE RELUCTANCE GENERATOR

REQUEST FOR RECONSIDERATION

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Applicant requests reconsideration of the July 28, 2005 Office Action.

The July 28, 2005 Office Action rejected claims 1-27 under 35 U.S.C. § 102(b) over Curtiss (U.S. Patent No. 4,400,655). Applicant respectfully traverses this rejection.

Curtiss Does Not Anticipate the Claimed Invention

For a number of different reasons, the claimed invention is not disclosed within the four corners of Curtiss. Because Curtiss does not anticipate the claimed invention, Applicant submits that the 35 U.S.C. § 102(b) rejection over Curtiss should be withdrawn.

No Variable Reluctance Machine, as Claimed

First, independent claim 16 recites a variable reluctance machine, and independent claim 1 recites a method of operating a variable reluctance machine. (Line 1 of each claim.) Curtiss fails to disclose, or even relate to, a variable reluctance machine. Instead, Curtiss shows an induction machine, and more specifically, an induction motor. Note, for example, the first line of the Abstract of Curtiss, which states, "An inverter controls an induction motor...". As is well known in the art, the structure, function, and fundamental principles of operation of induction

Request for Reconsideration

Applicant: Steven Paul Randall et al.

Serial No.: 10/765,506

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Docket No.: K315.133.101

Title: VARIABLE RELUCTANCE GENERATOR

machines are entirely different than those of variable reluctance machines. For this reason alone, Applicant submits that Curtiss does not anticipate independent claims 1 or 16 under 35 U.S.C. § 102(b).

No Generation of Electrical Power, as Claimed

Second, independent claim 16 recites a variable reluctance machine having a second part arranged to move relative to a first part *to generate* electrical power. Independent claim 1 recites a method of operating a variable reluctance machine *as a generator*. Note lines 1-2 of each claim. Curtiss, on the other hand, does not and cannot operate as a generator. It is an induction motor; it is not a generator. For this additional reason, Applicant submits that Curtiss fails to anticipate independent claim 1 and 16 under 35 U.S.C. § 102(b).

More specifically, the term “motor” is used throughout the Curtiss reference. This usage of the term “motor” is not accidental, as the power circuit of Curtiss cannot accept regenerated energy. There is only a path for power to flow *from* the supply *to* the motor. As shown in Figure 2 of Curtiss, power supply 2 is connected to the remaining circuit via rectifier 1. Because a rectifier is a one-way device (it serves to turn an alternating current into a unidirectional DC current), and current needs to flow from the supply to the remainder of the circuit for the motor to work, the current in Curtiss cannot flow back to the supply – and thus it is impossible to operate the circuit disclosed in Curtiss as a generator.

Accordingly, Applicant submits that Curtiss cannot anticipate independent claims 1 and 16, which recite a generator or generation of electrical power, because Curtiss lacks the structure, function, capability or intention of acting as a generator or to generate electrical power.

Request for Reconsideration

Applicant: Steven Paul Randall et al.

Serial No.: 10/765,506

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Docket No.: K315.133.101

Title: VARIABLE RELUCTANCE GENERATOR

No Bias Flux Linking the at Least One Phase Winding, as Claimed

Third, independent claim 1, line 3, recites creating a bias flux linking the at least one phase winding. Independent claim 16, line 3, recites means for creating a bias flux linking the at least one phase winding. The Office Action states that inductor 6 of Curtiss meets this feature. To the contrary, however, it does not. Curtiss' item 6 is a standard inductor in a DC link, used to smooth current ripple. Note column 4 of Curtiss, line 13, for example. It is not a part of the Curtiss induction motor. It does not produce flux – bias or otherwise – in the machine, so it cannot link the phase winding, as claimed. This feature of independent claims 1 and 16 simply is not anticipated, taught or suggested by Curtiss.

No Limiting of Phase Voltage, as Claimed

Fourth, independent claim 1, lines 4-5, recites “limiting the phase voltage to a magnitude below that otherwise induced in the phase winding by the bias flux”. Independent claim 16, lines 3-5, recites “means for limiting the magnitude of the phase voltage below that otherwise induced in the at least one phase winding by the bias flux”. Curtiss does not and cannot meet these features, because Curtiss has no bias flux inducing a voltage. The machine of Curtiss operates the other way around, because Curtiss relates to a motor.

Conclusion

In view of the foregoing, Applicant submits that independent claims 1 and 16, and their dependent claims 2-15 and 17-27, define patentable subject matter.

The Induction Machine of Curtiss is Entirely Contrary to the Claimed Invention

As is well known in the art, in switched reluctance machines, the mode of operation

Request for Reconsideration

Applicant: Steven Paul Randall et al.

Serial No.: 10/765,506

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Docket No.: K315.133.101

Title: VARIABLE RELUCTANCE GENERATOR

(motoring versus generating) depends on the timing of switching. In a generating mode, the conduction period serves to prime the phase winding to establish a flux that is converted to a generated current following the conduction period. For the first time, embodiments of the invention realize that the phase winding of the machine can be primed using a bias flux produced by a separate bias winding, thereby dispensing with the need for e.g. switches 21, 22 of the prior art switched reluctance machine shown in Figure 2 of the present application. Note dependent claims 12 and 16, for example, which both recite that the power converter (circuit, claim 12) is free of active switches. Because the switches in a drive are a major cost factor, embodiments of the invention are of significant technical and economic importance.

The inventive concepts apply particularly to variable reluctance machines, but not to all electrical machines in general. One example of an electrical machine to which the inventive concept does not apply at all is an induction machine – like that shown in Curtiss. Induction machines rely on currents induced in a winding on the rotor and a rotating magnetic field produced by the stator. The torque produced by an induction machine depends on the difference in speed between the rotor and the rotating stator field. If the rotor itself rotates at the same speed as the stator field moves around the stator, no torque is produced. If the stator field rotates faster, a positive torque is produced (the induction machine acting as a motor), and if the rotor rotates faster than the stator field, a negative torque is produced (the machine acting as a generator). Because an induction machine relies on rotating magnetic fields which are always present, the issue of priming the machine for the purpose of running it in a generating mode does not arise. Accordingly, the inventive concept defines no application in an induction machine such as that of Curtiss.

Request for Reconsideration

Applicant: Steven Paul Randall et al.

Serial No.: 10/765,506

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Docket No.: K315.133.101

Title: VARIABLE RELUCTANCE GENERATOR

Use of the terms “self generative” and “flux bias” in Curtiss

The term “self generative” appears in the title of Curtiss. In Curtiss, the term “self generative” does not refer to the induction motor acting as a generator. Instead, the term refers to the fact that the inverter and multiplexer of the control circuit in Curtiss are sequenced each time the comparator input reaches a reference level, such that the *frequency of the inverter* is self generated. Note the Abstract of Curtiss, for example, line 7. The term is further explained at e.g. column 3, lines 21-25, where it is stated that the motor voltage signals serve as primary means for advancing the inverter through its states such that no separate oscillators, counters or dividers are required and the system is thus self-regenerative. This is confirmed by column 9, lines 5-7, which make it clear that “self generating” refers to the excitation frequency such that a stator field is rotated automatically. The term “self generative” in Curtiss simply does not refer to an induction motor somehow acting as a generator.

Regarding the term “flux bias”, Figure 1 makes it clear that “flux bias 109” is a bias signal that is input into a comparator that compares current sensed by current sensor 209 to flux sensed by flux sensor 208. As set out in column 7, line 61 to column 8, line 4, the flux signal is summed with a signal proportional to motor stator current at summing point 104. The “bias flux” signal, then, is nothing more than a resistor connected between a DC supply terminal and the summing point. The bias flux signal effectively increases the flux to current ratio at low flux levels. This is useful to allow a finite link current to exist, even at low torque levels, and thus to provide stable operation in this operating regime. The bias flux signal of Curtiss is simply not the claimed bias flux linking the at least one phase winding, as recited in independent claim 1,

Request for Reconsideration

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Title: VARIABLE RELUCTANCE GENERATOR

line 3 and independent claim 16, line 3.

In summary, Curtiss is in a completely different field, in which technical aspects addressed by embodiments of the present invention do not even arise. Curtiss discloses none of the features of the independent claims and is entirely irrelevant to the patentability of the present invention. It certainly is not, Applicant submits, an anticipatory reference under 35 U.S.C. § 102(b).

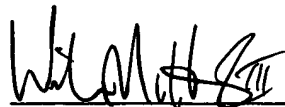
Conclusion

In view of the foregoing, Applicant submits that this application is in condition for allowance. Favorable reconsideration and prompt allowance are requested. The Commissioner is hereby authorized to grant any extensions of time and to charge any fees under 37 C.F.R. § 1.16 and § 1.17 that may be required during the entire pendency of this application, or to credit any overpayment, to Deposit Account No. 500471.

The Examiner is invited to telephone the undersigned to advance prosecution.

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Respectfully submitted,



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Please grant any extension of time necessary for entry; charge any fee due to Deposit Account No. 500471.

CERTIFICATE UNDER 37 C.F.R. 1.8:

The undersigned hereby certifies that this paper or papers, as described herein, are being deposited in the United States Postal Service, as first class mail with sufficient postage, in an envelope addressed to: Mail Stop Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on this 21st day of October, 2005.

By 
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